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Updated Cost Evaluation of a Metal and Mineral Recovery Process for Treating Municipal Incinerator Residues

UNITED STATES DEPARTMENT OF THE INTERIOR

U.S. Bureau of Mines

Information Circular 8691

Updated Cost Evaluation of a Metal and Mineral Recovery Process for Treating Municipal Incinerator Residues

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UNITED STATES DEPARTMENT OF THE INTERIOR
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BUREAU OF MINES
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UPDATED COST EVALUATION OF A METAL AND MINERAL RECOVERY PROCESS FOR TREATING MUNICIPAL INCINERATOR RESIDUES

by

John J. Henn[1]

ABSTRACT

An economic evaluation was made of the Bureau of Mines incinerator residue separation process to update the one published in 1971 to a mid-1974 cost basis. This evaluation includes a modification of the glass-recovery operation used in the original plant design as well as a unit to bale the ferrous scrap product before shipment. Products from the plant are ferrous metal, aluminum and copper-zinc scrap, and a mixed-color glass cullet.

The estimated capital and operating costs for four plant sizes are as follows:

Separation plant size (dry feed basis)	Fixed capital cost (mid-1974 basis)	Operating cost per ton of incinerator residue (dry basis)
250 tpd, 8-hour day.....	$2,337,500	$7.41
400 tpd, 8-hour day.....	2,792,500	5.40
670 tpd, 24-hour day.....	2,280,700	4.71
1,000 tpd, 24-hour day....	2,630,900	3.46

The operating costs do not include credits for recovered metals and glass.

INTRODUCTION

Every day large quantities of metal and mineral values are discarded in the form of municipal incinerator residues. These residues contain iron, nonferrous metals, and glass that can be recovered and recycled. The Bureau of Mines, in its research on methods of handling solid waste, first established methods for sampling and characterizing incinerator residues from urban refuse (3).[2] Later, a pilot plant was designed to process 1,000 pounds per hour of municipal incinerator residues from which ferrous metals, nonferrous metals, and two grades of glass product were obtained (5). An economic evaluation of the initial process design was published in 1971 (2).

[1] Chemical engineer.

[2] Underlined numbers in parentheses refer to items in the list of references preceding the appendix.

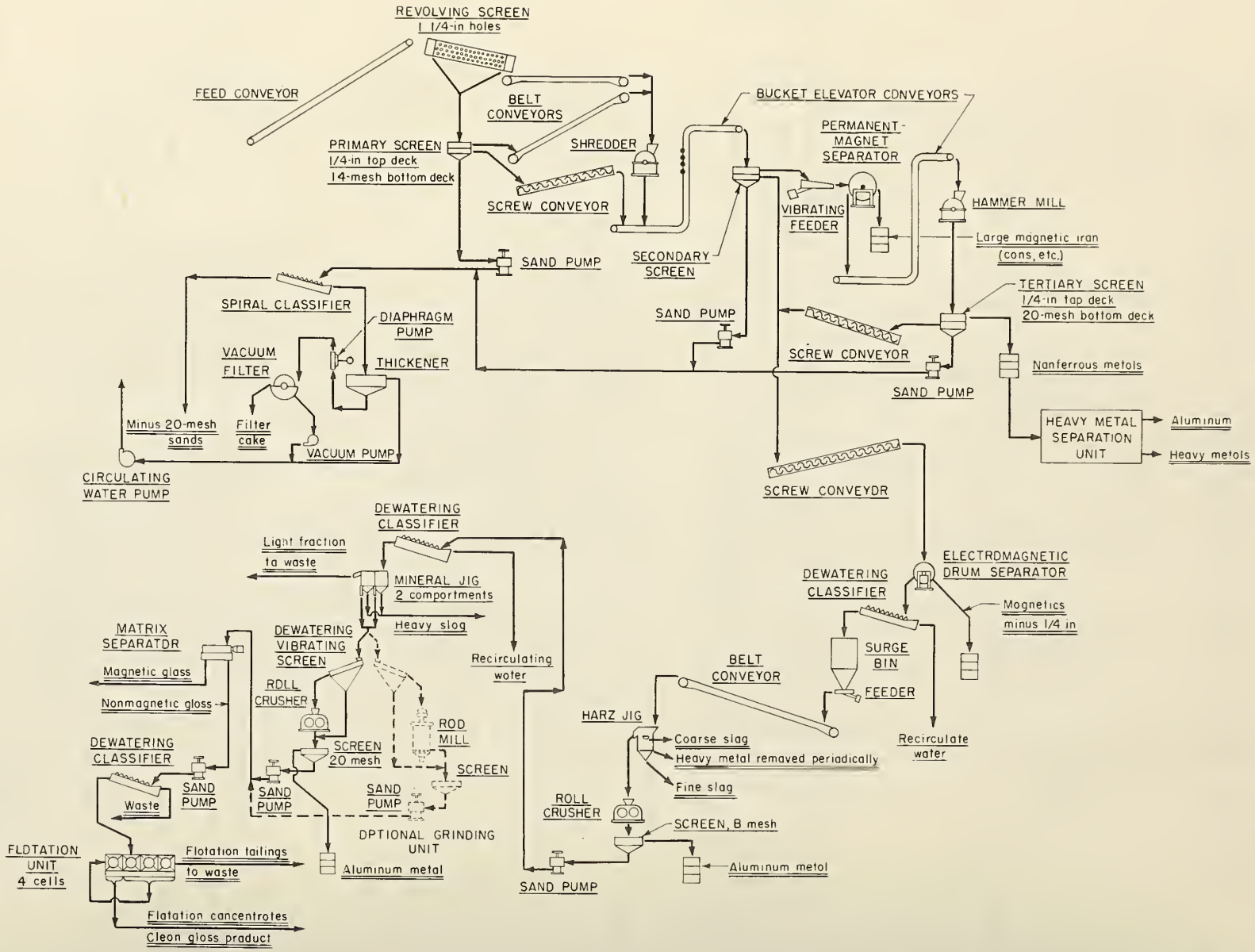

FIGURE 1. - Pilot plant flow diagram.

Since publication of the original economic evaluation of the incinerator residue process, the process has been modified to obtain an improved grade of glass product. The process modification consists primarily of substituting roll crushing for rodmilling and adding two separate jigging operations and flotation. In addition, the two-stage high-intensity magnetic separation step has been reduced to a single-stage operation. The single glass product from the present plant is of a higher quality than either of the glass fractions recovered in the original process design. The economic evaluation presented in this report is for the current incinerator residue plant design and is based on mid-1974 costs.

Data used in publication of the earlier report on process economics were obtained during pilot plant operations utilizing incinerator residues primarily from the metropolitan Washington, D.C., area. The present evaluation is based on data from many more days of operations on incinerator residues from other cities in addition to Washington, D.C., such as New Orleans, La.; Chicago, Ill.; Dayton, Ohio; Stamford, Conn.; North Hempstead and Roslyn, N.Y.; and Lowell and Newton, Mass. A schematic representation of the pilot plant is shown in figure 1.

DESCRIPTION OF PROCESS

The separation process is designed to recover ferrous metals, nonferrous metals, and glass from incinerator residues. It is assumed that the incinerator burns urban refuse that would normally be collected from a city or town and not industrial refuse from a particular plant. The plant separates the residue into various metal and mineral products, and greatly reduces the volume of waste sent to landfills.

It is assumed that incinerator residues fed to the plant are properly incinerated; that is, they contain a minimum of unburned paper, rags, and other combustibles, and that the conventional incinerator practice of residue quenching is followed. The wet residue is assumed to be fed to the separation plant directly from the incinerator; however, provision is made for receiving residue by truck so that one large separation plant can serve a number of incinerators. The entire separation process is operated wet, using water sprays to wash materials in the trommel and on screens and magnetic separators. The water used in washing is recovered and recycled so that no pollution will occur from discarding it.

A process flow diagram is shown in figure 2, and the incinerator residue analysis is shown in table 1. Table 2 shows the estimated quantities of the various fractions recovered for each of the four plant sizes. A material balance for the 1,000-ton-per-day plant (dry residue basis) is shown in figures D-1 through D-4 in appendix D. Flow rates for the other plants may be calculated by using factors from this balance, such as 0.25 for the 250-ton-per-day plant.

TABLE 1. - Analysis of the incinerator residue, dry basis

Residue	Percent
Wire and large iron	3.0
Tin cans	13.6
Small ferrous metal	13.9
Nonferrous metal	2.8
Glass, slag, and ceramics	53.1
Ash, grit, and dirt	13.6
Total	100.0

TABLE 2. - Quantity of the various fractions recovered, tons per day

	Plant capacity			
	250 tpd	400 tpd	670 tpd	1,000 tpd
Plus 4-mesh ferrous metal	41	66	111	166
Minus 4- plus 20-mesh ferrous metal	35	56	93	139
Aluminum	4	6	11	16
Copper-zinc	3	5	8	12
Glass	59	94	158	235
Waste solids	108	173	289	432

Primary Separation and Water Recovery Section

Wet incinerator residue is conveyed to a trommel to remove the plus 1-1/4-inch material for shredding in a hammer mill shredder. Large pieces of metal that may damage the shredder are removed by hand from the conveyor following the trommel and are conveyed to the shipping area.

Minus 1-1/4-inch material from the trommel is fed to a double-deck screen, referred to as the primary screen, from which three size fractions are obtained. The largest size fraction, plus 1/4 inch, is conveyed to the shredder where it is combined with the plus 1-1/4 inch oversize from the trommel. The minus 1/4-inch plus 14-mesh middle fraction from the primary screen is conveyed to an electromagnetic drum separator. The undersize, containing the minus 14-mesh solids and the screen wash water, is pumped to a spiral classifier for dewatering.

The material leaving the shredder feeds a second double-deck screen. Oversize, plus 1/4 inch, from this secondary screen is conveyed to a permanent-magnet drum separator. The middle fraction, minus 1/4-inch plus 20-mesh material from the secondary screen is conveyed to the same electromagnetic drum separator as the middle fraction from the primary screen. The wash water and the minus 20-mesh solids are pumped to the dewatering spiral classifier.

The waste solids from the primary and secondary screens as well as from other operations in the plant are dewatered by treatment in a spiral classifier, followed by thickening and filtration. The waste material is composed

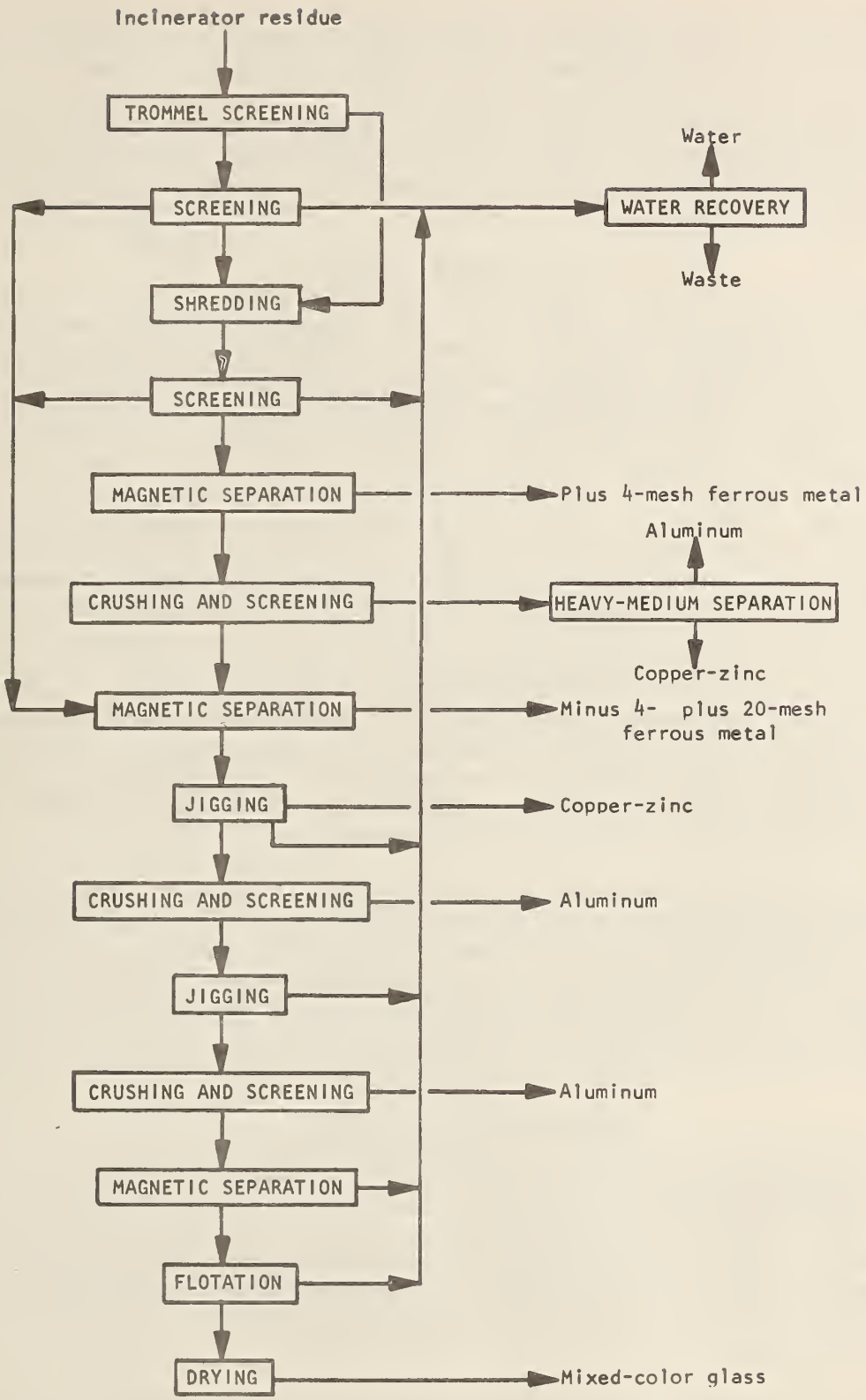

FIGURE 2. - Incinerator residue separation process.

principally of fine ash, carbon, dirt, fine glass, ceramics, other nonmetals, and metal oxides. A flocculant is added to the overflow from the dewatering spiral classifier as it is pumped to a thickener. With the flocculant, the solids entering the thickener settle at a rate of 11 feet per hour and, after removal from the thickener, are dewatered on a rotary vacuum filter. The solids removed from the dewatering spiral classifier and the filter are trucked to a landfill site. The water recovered from the thickener and filter is reused in the plant.

Metal Recovery Section

In this section, two ferrous metal fractions and one nonferrous metal fraction are separated from the incinerator residue. One of the ferrous fractions is a plus 1/4-inch material consisting primarily of tin cans; the other is a minus 1/4-inch plus 20-mesh material composed of mill scale, small screws, nuts, bolts, pins, and the like. The nonferrous fraction is a plus 1/4-inch material composed primarily of aluminum, copper, and zinc.

To recover the plus 1/4-inch ferrous metal and the nonferrous metal, the oversize from the secondary screen is fed to a permanent-magnet drum separator. The magnetic concentrate from the separator is the plus 1/4-inch ferrous metal product that is collected and conveyed to a baling unit where it is compressed into bales that are then loaded into a railroad car. The nonmagnetic tailings from the magnetic separator are fed to a hammer mill for further size reduction. The material leaving the hammer mill is fed to a tertiary, double-deck screen. Plus 1/4-inch material from the screen consists of nonferrous metal that is conveyed to the nonferrous metals upgrading section. The minus 1/4-inch plus 20-mesh middle fraction is conveyed to an electromagnetic drum separator; the minus 20-mesh fines are conveyed to the dewatering spiral classifier in the primary separation and water recovery section.

The second ferrous metal fraction is recovered, using an electromagnetic drum separator, from the minus 1/4-inch plus 20-mesh middle fractions from the primary, secondary, and tertiary screens. The ferrous product, magnetic concentrate recovered from the separator, is conveyed to the baling unit and baled with the plus 1/4-inch ferrous metal. The nonmagnetic tailings from the electromagnet drum separator is partially dewatered with a spiral classifier before it is sent to the glass recovery section.

Glass Recovery Section

The solids leaving the spiral classifier in the metal recovery section are fed to Harz jigs where most of the heavy slag is removed from the glass. Fine slag passes into the hutch and coarse slag is discharged from the cup. The two slag products are combined and sent to the primary separation and water recovery section. Heavy nonferrous metal accumulates in the jig bed and is removed periodically as a copper-zinc product. Glass and aluminum with lighter contaminants overflow the end of the jig.

The overflow material is crushed in a roll crusher and passed through an 8-mesh screen to remove aluminum. The minus 8-mesh material is fed to a

spiral classifier to remove unwanted fines. The overflow from the spiral classifier is sent to the thickener in the primary separation and water recovery section, and the solids are fed to modified mineral jigs.

In the mineral jigs, additional fine slag collects in the hutch. Glass, aluminum, and ceramics discharge from the cup and light contaminants overflow the end of the jig. The glass recovered from the mineral jigs goes to another stage of roll crushing followed by screening on 20 mesh to reclaim a small amount of fine aluminum.

The minus 20-mesh material is fed to a high-intensity, matrix-type magnetic separator to remove any magnetic material that was liberated during crushing, including feebly magnetic particles. The nonmagnetics are pumped to a spiral classifier and deslimed to approximately 150 mesh. The slime overflow is sent to the thickener in the primary separation and water recovery section. The solids leaving the spiral classifier are fed to flotation cells for final cleanup. The tailings from flotation consist of ceramics, bricks, stones, etc., and are sent to the dewatering spiral classifier in the primary separation and water recovery section.

After dewatering, the flotation concentrate is fed to a rotary dryer to remove the remaining water and yield a high-grade mixed-color glass product.

Nonferrous Metals Upgrading Section

Nonferrous metals recovered in the metal recovery section are fed to a heavy-medium separator containing a ferrosilicon-water slurry having a specific gravity of 2.95. In this separator, the light aluminum fraction of the nonferrous metals floats while the heavier copper-zinc fraction sinks. Two separate streams exit from the separator--one containing the sink fraction and the other, the float fraction.

The sink and float fractions go to separate screens where most of the fine ferrosilicon material is removed from the larger nonferrous metal and collected in a tank. The nonferrous metals are then transferred to screens equipped with water sprays to wash the remaining ferrosilicon from the metals. The float product, containing about 96 percent aluminum, and the sink product, containing about 50 percent copper and 40 percent zinc, are each conveyed to the product shipping area.

The diluted ferrosilicon recovered from the washing screens is fed to a magnetic separator to eliminate nonmagnetic fines that might build up in the operation. From the magnetic separator, the ferrosilicon is sent to a densifier that dewaters the ferrosilicon to a point where it can be reused in the heavy-medium separator. The dewatered ferrosilicon is then mixed with the undiluted ferrosilicon removed from the nonferrous metals before washing, and is recycled to the heavy-medium separator vessel.

PROCESS ECONOMICS

The costs shown in this report are for the present plant design. All costs are given on a mid-1974 basis.

Four plant sizes are considered in this evaluation. Two plants, operating on a 24-hour-per-day, 5-day-per-week basis, have capacities of 1,280 and 858 tons per day of wet incinerator residues, equivalent to 1,000 and 670 tons per day on a dry basis, respectively. The other two plants operate 8 hours per day, 5 days per week, and treat 512 and 320 tons per day of wet incinerator residues, equivalent to 400 and 250 tons per day on a dry basis, respectively. The nonferrous metals upgrading section is operated 8 hours per day, 5 days per week in all four plants. For this evaluation, it is considered that the separation plant is operating in conjunction with an incinerator and that the same maintenance crew will be used for both the incinerator and the separation plant.

Capital Costs

The capital cost estimates are of the general type called "study estimates" by Weaver and Bauman (6) and are expected to be within 30 percent of the actual cost. The fixed capital costs on a mid-1974 basis for the four plants are shown in table 3.

TABLE 3. - Estimated capital costs[1]

	Plant capacity, tons per day			
	250	400	670	1,000
Fixed capital:				
Primary separation and water recovery section	$681,200	$820,200	$642,500	$756,900
Metal recovery section	414,900	434,200	415,400	429,000
Glass recovery section	822,400	1,056,400	803,900	975,300
Nonferrous metals upgrading section	96,600	96,600	104,300	106,800
Subtotal	2,015,100	2,407,400	1,966,100	2,268,000
Plant facilities, 10 percent of subtotal	201,500	240,700	196,600	226,800
Plant utilities, 6 percent of subtotal	120,900	144,400	118,000	136,100
Fixed capital cost	2,337,500	2,792,500	2,280,700	2,630,900
Working capital:				
Raw material and supplies	2,100	2,800	2,900	3,800
Product and in-process inventory	40,100	46,700	68,400	74,700
Accounts receivable	40,100	46,700	68,400	74,700
Available cash	24,900	28,800	50,000	54,300
Working capital cost	107,200	125,000	189,700	207,500
Total capital cost	2,444,700	2,917,500	2,470,400	2,838,400

[1]Basis: M and S index = 386.1.

Cost-capacity data of the type shown by Bauman (1) and Mills (4) are used as the principal sources of equipment costs. The costs of the major items of equipment and their accessories are tabulated for each section in the appendixes at the end of this report. Factors for piping, instruments, and the like are assigned to each section, depending on whether fluids, a combination of fluids and solids, or solids are handled. These factors are shown for each section in the appendixes. A factor of 10 percent, referred to as miscellaneous, is added to each section to cover minor equipment and construction costs that are not shown with the equipment listed for the section.

For each section, the "field indirect," which covers field supervision, inspection, temporary construction, equipment rental, and payroll overhead, is estimated at 10 percent of the direct cost. Both the cost of engineering and that of administration and overhead are estimated at 5 percent of the construction cost. A contingency of 10 percent and a contractor's fee of 5 percent are included in the section cost.

The costs of plant facilities are estimated as 10 percent of the total process section costs. Plant utility costs are estimated at only 6 percent of the process section costs because it is assumed that the plant is located at an existing incinerator and major utilities would be available. The costs for plant facilities and utilities include the same field indirect, engineering, administration and overhead, contingency, and contractor's fee as are included in the section costs. Included under plant facilities are the costs of laboratories, shops, roads, and fences. The costs of water and power distribution systems are included under plant utilities. Because the plant location has not been selected, the cost of land is not included. Also, startup costs are not included in the estimates.

Working capital is defined as "the funds in addition to fixed capital, land investment, and startup costs that must be provided to operate a plant." Working capital is estimated from the following items: (1) raw materials and supplies inventory (cost of raw materials and operating supplies for 1 month), (2) product and in-process inventory (total operating cost for 1 month), (3) accounts receivable (total operating cost for 1 month), and (4) available cash (direct expenses for 1 month). The estimated working capital for each plant is included in table 3.

Operating Costs

The estimated operating costs, divided into direct, indirect, and fixed costs, are based on a 260-day operating year. Included in the direct operating costs are raw materials, utilities, labor, maintenance, payroll overhead, and operating supplies.

Direct labor cost is estimated on the basis of manning the plant with three men for each position that operates 24 hours per day, 5 days per week, and with one man for each position that operates 8 hours per day, 5 days per week. This process requires both skilled and unskilled workers, so a wage rate of $5 per hour was used in estimating the operating cost. The wage is an an average of wages for laborers and for several skilled operators. The

direct labor assignments are shown by section in the appendixes. The cost of supervision is estimated as 25 percent of the labor cost.

Electricity, water, and natural gas are purchased utilities. Plant maintenance is separately estimated for each piece of equipment and for the buildings, electrical system, piping, plant utility distribution system, plant facilities, etc. Operating supplies are 20 percent of the cost of plant maintenance. Payroll overhead includes vacations, social security, and fringe benefits.

Because this is a municipal government operation and not a corporation with a large overhead, indirect costs are estimated at 20 percent of the direct labor and maintenance costs. The indirect costs include the expenses of control laboratories, accounting, plant protection and safety, plant administration, and marketing.

Fixed costs include the cost of insurance and depreciation. The annual cost of insurance is estimated as 1 percent of the plant cost. Depreciation is based on a straight-line, 20-year period. No local taxes are included in the fixed costs because it is assumed that the plants will be operated by a city or State government.

Operating costs of all four plants are shown in dollars per ton of dry incinerator residue fed to the plant. These costs represent the expense of separating the incinerator residue into ferrous metal, aluminum scrap, copper-zinc scrap, and a glass fraction. The estimated costs do not include the costs of incineration and trucking to the plant or the costs of additional upgrading and waste-solid disposal. The estimated operating costs, itemized in tables A-8, B-8, C-8, and D-8, are summarized in table 4.

TABLE 4. - Summary of estimated operating costs

Capacity, tons per day incinerator residue (dry basis)	Operating time, hours per day	Estimated operating cost per ton of dry incinerator residue
250.....	8	$7.41
400.....	8	5.40
670.....	24	4.71
1,000.....	24	3.46

Products and Profitability

The products recovered from the incinerator residues are ferrous metal scrap, aluminum scrap, a mixed copper-zinc scrap, and a mixed-color glass cullet. For this evaluation, it was assumed that all the ferrous metals recovered in the plant could be baled together. However, it is quite likely that only the large ferrous metal fraction can be baled causing the small ferrous metal fraction to be shipped as a loose material. Should this be the case, the effect of collecting two separate ferrous metal products, one baled and the other loose, will have little effect on the estimated operating costs. The two nonferrous metal products will be shipped loose as will the glass

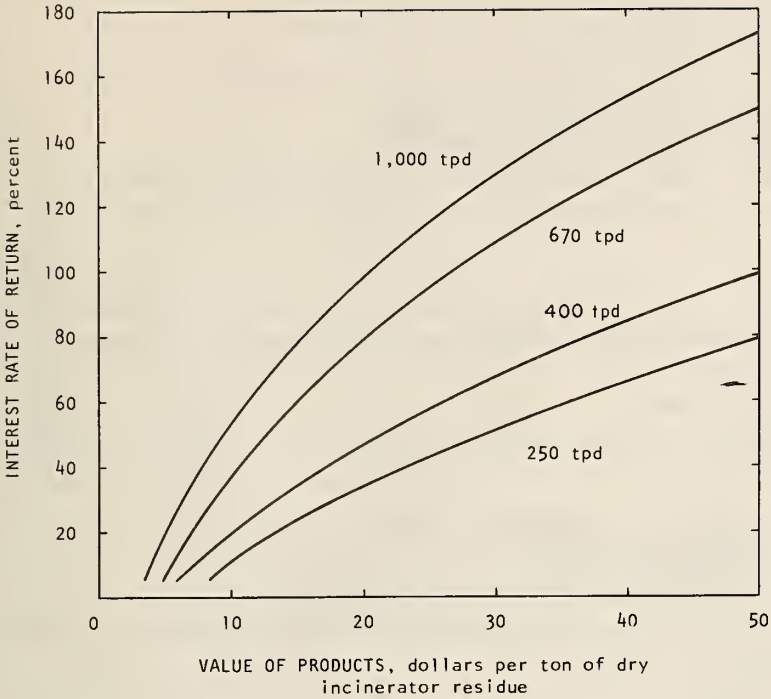

FIGURE 3. - Variation in interest rate of return with value of combined products.

cullet. The glass cullet recovered in this plant is of good quality, being relatively free of undesirable contaminants such as ceramics.

No attempt was made to tabulate the expected values of the various products recovered from the separation plant, primarily because of the increasing values of scrap materials. The product values, however, will also vary with plant location, product quality, and market conditions. For this evaluation, no plant location was selected, so the locations of scrap markets are unknown.

Because no specific credit is allowed in the economic evaluation of the separation plant for the various products, figure 3 is included to gage the profitability of the process. With this figure, the interest rate of return on investment can be determined for values of combined products up to $50 per ton of incinerator residues. To estimate the profitability of a plant in a given location, the market value of all the products should be determined at the plant site, then the interest rate of return can be determined for each of the four plant sizes evaluated in this report.

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APPENDIX A.--250-TON-PER-DAY INCINERATOR RESIDUE PLANT--8-HOUR DAY

TABLE A-1. - Raw material, utility, and labor requirements 250-tpd incinerator residue plant--8-hour day

	Quantity per ton of dry incinerator residue
Flocculant.....pound..	0.02
Ferrosilicon.....do....	0.01
Flotation reagent.....do....	0.08
Electric power.....kilowatt-hours..	13.30
Process water.....thousand gallons..	0.07
Natural gas.....million Btu..	0.13
Direct operating labor.....man-hour..	0.29

TABLE A-2. - Major items of equipment, 250-tpd incinerator residue plant--8-hour day

Section and item	Quantity	Unit size
Primary separation and water recovery:		
Trommel.....	1	6 feet in diameter by 12 feet long.
Shredder.....	1	500 horsepower.
Thickener.....	1	43 feet in diameter.
Rotary vacuum filter.....	1	250 square feet.
Metal recovery:		
Permanent-magnet drum separator	1	30 inches in diameter by 18 inches wide.
Baler.....	1	100 horsepower.
Hammer mill.....	1	7.5 horsepower.
Electromagnet drum separator...	1	30 inches in diameter by 18 inches wide.
Glass recovery:		
Harz jig.....	4	24 by 36 inches, 4 compartments.
Roll crusher.....	1	15 horsepower.
Mineral jig.....	2	16 by 24 inches, duplex.
Roll crusher.....	1	15 horsepower.
Matrix-type, high-intensity magnetic separator.....	1	10 tons per hour.
	1	5 tons per hour.
Flotation unit.....	1	38 by 38 inches, 6 cells.
Dryer.....	1	4.5 feet in diameter by 45 feet long.
Nonferrous metals upgrading:		
Heavy-medium separator.....	1	1.5 feet in diameter by 4 feet long.
Permanent-magnet drum separator	1	30 inches in diameter by 12 inches wide.

TABLE A-3.-EQUIPMENT COST SUMMARY,
PRIMARY SEPARATION AND WATER RECOVERY SECTION
250 TPD INCINERATOR RESIDUE PLANT--8 HOUR DAY

ITEM	COST(1) EQUIPMENT	LABOR	TOTAL
HOPPER	$ 1700	$ 100	$ 1800
APRON FEEDER	5500	800	6300
BELT CONVEYOR	23300	4200	27500
TROMMEL	13600	1600	15200
BELT CONVEYOR	16000	2900	18900
BELT CONVEYOR	10000	1800	11800
PRIMARY SCREEN	3000	400	3400
BELT CONVEYOR	6900	1200	8100
BELT CONVEYOR	7500	1300	8800
PUMP	1700	100	1800
SURGE BIN	5400	300	5700
APRON FEEDER	5500	800	6300
SHREDDER	55800	7800	63600
SECONDARY SCREEN	2400	300	2700
BUCKET ELEVATOR	4200	600	4800
BELT CONVEYOR	5800	1000	6800
PUMP	1100	100	1200
SPIRAL CLASSIFIER	4500	400	4900
PUMP	900	100	1000
BELT CONVEYOR	5200	900	6100
SURGE HOPPER	400	100	500
MIXING TANK	3000	300	3300
METERING PUMPS	900	100	1000
SCALE	200	100	300
THICKENER	19800	2000	21800
PUMP	1500	100	1600
PUMPS	3900	100	4000
ROTARY VACUUM DRUM FILTER	30700	3100	33800
BELT CONVEYOR	2900	500	3400
STORAGE TANK	10700	1100	11800
PUMP	3200	200	3400
TOTAL	257200	34400	291600
FRONT END LOADER			8100
TOTAL EQUIPMENT COST X FACTOR INDICATED			
FOUNDATIONS, X .070			18000
BUILDINGS, X .250			64300
STRUCTURES, X .050			12900
INSTRUMENTATION, X .010			2600
ELECTRICAL, X .140			36000
PIPING, X .100			25700
PAINTING, X .010			2600
MISCELLANEOUS, X .100			25700
TOTAL			187800
TOTAL DIRECT COST			487500
FIELD INDIRECT, 10.0 PERCENT OF TOTAL DIRECT COST			48700
TOTAL CONSTRUCTION COST			536200
ENGINEERING, 5.0 PERCENT OF TOTAL CONSTRUCTION COST			26800
ADMINISTRATION AND OVERHEAD, 5.0 PERCENT OF TOTAL CONSTRUCTION COST			26800
SUBTOTAL			589800
CONTINGENCY, 10.0 PERCENT OF ABOVE SUBTOTAL			59000
SUBTOTAL			648800
CONTRACTOR'S FEE, 5.0 PERCENT OF ABOVE SUBTOTAL			32400
SECTION COST			681200

(1) EQUIPMENT COSTS ARE BASED ON THE M AND S INDEX OF 386.1.

TABLE A-4.-EQUIPMENT COST SUMMARY, METAL RECOVERY SECTION
250 TPD INCINERATOR RESIDUE PLANT--8 HOUR DAY

ITEM	COST(1) EQUIPMENT	LABOR	TOTAL
MAGNETIC SEPARATOR	$ 6200	$ 600	$ 6800
BELT CONVEYOR	9900	1800	11700
SURGE HOPPER	200	100	300
APRON FEEDER	3700	600	4300
BALER	79800	20000	99800
ROLLER CONVEYOR	2100	300	2400
CAR PULLER	2500	200	2700
HAMMERMILL	2600	400	3000
TERTIARY SCREEN	2100	300	2400
BELT CONVEYOR	5700	1000	6700
BELT CONVEYOR	7400	1300	8700
SURGE HOPPER	800	100	900
PUMP	1500	100	1600
MAGNETIC SEPARATOR	8500	800	9300
BELT CONVEYOR	7400	1300	8700
SURGE HOPPER	300	100	400
SPIRAL CLASSIFIER	5000	500	5500
PUMP	800	100	900
TOTAL	146500	29600	176100
CRANE			(2) 6600
TOTAL EQUIPMENT COST X FACTOR INDICATED			
FOUNDATIONS, X .070			10300
BUILDINGS, X .250			36600
STRUCTURES, X .100			14600
INSTRUMENTATION, X .010			1500
ELECTRICAL, X .140			20500
PIPING, X .100			14600
PAINTING, X .010			1500
MISCELLANEOUS, X .100			14600
TOTAL			114200
TOTAL DIRECT COST			296900
FIELD INDIRECT, 10.0 PERCENT OF TOTAL DIRECT COST			29700
TOTAL CONSTRUCTION COST			326600
ENGINEERING, 5.0 PERCENT OF TOTAL CONSTRUCTION COST			16300
ADMINISTRATION AND OVERHEAD, 5.0 PERCENT OF TOTAL CONSTRUCTION COST			16300
SUBTOTAL			359200
CONTINGENCY, 10.0 PERCENT OF ABOVE SUBTOTAL			35900
SUBTOTAL			395100
CONTRACTOR'S FEE, 5.0 PERCENT OF ABOVE SUBTOTAL			19800
SECTION COST			414900

(1) EQUIPMENT COSTS ARE BASED ON THE M AND S INDEX OF 386.1.
(2) INSTALLED COST.

TABLE A-5.-EQUIPMENT COST SUMMARY, GLASS RECOVERY SECTION
250 TPD INCINERATOR RESIDUE PLANT--8 HOUR DAY

ITEM	COST(1) EQUIPMENT	LABOR	TOTAL
HARZ JIG	$ 36500	$ 3600	$ 40100
PUMP	1700	100	1800
BELT CONVEYOR	6700	1200	7900
ROLL CRUSHER	8800	900	9700
VIBRATING SCREEN	2200	300	2500
BELT CONVEYOR	7400	1300	8700
PUMP	2600	100	2700
SPIRAL CLASSIFIER	5000	500	5500
PUMP	3100	100	3200
MINERAL JIG	9800	1000	10800
PUMP	1500	100	1600
PUMP	1800	100	1900
VIBRATING SCREEN	2700	300	3000
PUMP	1600	100	1700
ROLL CRUSHER	8800	900	9700
VIBRATING SCREEN	3300	400	3700
PUMP	2200	100	2300
MATRIX SEPARATOR	56100	5600	61700
MATRIX SEPARATOR	37500	3700	41200
PUMP	1500	100	1600
PUMP	2200	100	2300
SPIRAL CLASSIFIER	5000	500	5500
PUMP	2500	100	2600
FLOTATION UNIT	11300	1100	12400
PUMP	1500	100	1600
VIBRATING SCREEN	1900	200	2100
PUMP	500	100	600
BELT CONVEYOR	7000	1300	8300
GLASS DRYER	59400	9500	68900
HOPPER	200	100	300
SCREW FEEDER	1100	200	1300
CYCLONE DUST COLLECTOR	3000	300	3300
BELT CONVEYOR	10400	1900	12300
STORAGE BIN	3500	200	3700
TOTAL	310300	36200	346500
TOTAL EQUIPMENT COST X FACTOR INDICATED			
FOUNDATIONS, X .070			21700
BUILDINGS, X .250			77600
STRUCTURES, X .100			31000
INSTRUMENTATION, X .010			3100
ELECTRICAL, X .140			43400
PIPING, X .100			31000
PAINTING, X .010			3100
MISCELLANEOUS, X .100			31000
TOTAL			241900
TOTAL DIRECT COST			588400
FIELD INDIRECT, 10.0 PERCENT OF TOTAL DIRECT COST			58800
TOTAL CONSTRUCTION COST			647200
ENGINEERING, 5.0 PERCENT OF TOTAL CONSTRUCTION COST			32400
ADMINISTRATION AND OVERHEAD, 5.0 PERCENT OF TOTAL CONSTRUCTION COST			32400
SUBTOTAL			712000
CONTINGENCY, 10.0 PERCENT OF ABOVE SUBTOTAL			71200
SUBTOTAL			783200
CONTRACTOR'S FEE, 5.0 PERCENT OF ABOVE SUBTOTAL			39200
SECTION COST			822400

(1) EQUIPMENT COSTS ARE BASED ON THE M AND S INDEX OF 386.1.

TABLE A-6.-EQUIPMENT COST SUMMARY,
NONFERROUS METALS UPGRADING SECTION
250 TPD INCINERATOR RESIDUE PLANT--8 HOUR DAY

ITEM	COST(1) EQUIPMENT	LABOR	TOTAL
HEAVY-MEDIUM SEPARATOR.....	$ 4400	$ 900	$ 5300
SINK DRAINAGE SCREEN.....	1400	200	1600
SINK WASHING SCREEN.....	1600	200	1800
FLOAT DRAINAGE SCREEN.....	1400	200	1600
FLOAT WASHING SCREEN.....	1600	200	1800
DILUTE MEDIUM SUMP.....	600	100	700
MAGNETIC FLOCCULATOR.....	200	100	300
MAGNETIC SEPARATOR.....	5400	500	5900
PUMP.....	500	100	600
DENSIFIER.....	3700	400	4100
STORAGE TANK.....	1000	100	1100
PUMP.....	500	100	600
DENSE MEDIUM SUMP.....	2700	100	2800
PUMP.....	1500	100	1600
BELT CONVEYOR.....	5100	900	6000
BELT CONVEYOR.....	5100	900	6000
DEMAGNETIZING COIL.....	200	100	300
TOTAL.....	36900	5200	42100
TOTAL EQUIPMENT COST X FACTOR INDICATED			
FOUNDATIONS, X .070.....			2600
BUILDINGS, X .250.....			9200
STRUCTURES, X .050.....			1800
INSTRUMENTATION, X .010.....			400
ELECTRICAL, X .140.....			5200
PIPING, X .100.....			3700
PAINTING, X .010.....			400
MISCELLANEOUS, X .100.....			3700
TOTAL.....			27000
TOTAL DIRECT COST.....			69100
FIELD INDIRECT, 10.0 PERCENT OF TOTAL DIRECT COST.....			6900
TOTAL CONSTRUCTION COST.....			76000
ENGINEERING, 5.0 PERCENT OF TOTAL CONSTRUCTION COST...			3800
ADMINISTRATION AND OVERHEAD, 5.0 PERCENT OF TOTAL CONSTRUCTION COST.....			3800
SUBTOTAL.....			83600
CONTINGENCY, 10.0 PERCENT OF ABOVE SUBTOTAL.....			8400
SUBTOTAL.....			92000
CONTRACTOR'S FEE, 5.0 PERCENT OF ABOVE SUBTOTAL.....			4600
SECTION COST.....			96600

(1) EQUIPMENT COSTS ARE BASED ON THE M AND S INDEX OF 386.1.

TABLE A-7.-DIRECT LABOR REQUIREMENTS,
250 TPD INCINERATOR RESIDUE PLANT--8 HOUR DAY

SECTION AND ITEM	DIRECT LABOR ASSIGNMENT			
	NUMBER OF MEN	SHIFTS PER DAY	DAYS PER WEEK	TOTAL MEN REQUIRED
PRIMARY SEPARATION AND WATER RECOVERY SECTION				
FRONT END LOADER	1.0	1	5	1.0
TROMMEL	2.0	1	5	2.0
SHREDDER	1.0	1	5	1.0
SUBTOTAL				4.0
METAL RECOVERY SECTION				
BALER	1.0	1	5	1.0
CRANE	1.0	1	5	1.0
HAMMERMILL	1.0	1	5	1.0
SUBTOTAL				3.0
GLASS RECOVERY SECTION				
HARZ JIG	1.0	1	5	1.0
SUBTOTAL				1.0
NONFERROUS METALS UPGRADING SECTION				
HEAVY-MEDIUM SEPARATOR	1.0	1	5	1.0
SUBTOTAL				1.0
TOTAL				9.0

TABLE A-8.-ESTIMATED ANNUAL OPERATING COST, 250 TPD INCINERATOR RESIDUE PLANT--8 HOUR DAY

	ANNUAL COST	COST PER TON INCINERATOR RESIDUE
DIRECT COST		
RAW MATERIALS		
INCINERATOR RESIDUE AT $ .00 PER TON	$ 0	$ .00
FLOCCULANT AT $1.70 PER POUND	2000	.03
FLOTATION REAGENT AT $ .67 PER POUND	3700	.06
FERROSILICON AT $ .16 PER POUND	100	.01
TOTAL	5800	.10
UTILITIES		
ELECTRIC POWER AT 1 CENT PER KWHR	8600	.13
WATER, PROCESS AT 50 CENTS PER MGAL	2200	.03
NATURAL GAS AT 80 CENTS PER MMBTU	6800	.10
TOTAL	17600	.26
DIRECT LABOR		
LABOR AT $5.00 PER HOUR	93600	1.44
SUPERVISION, 25 PERCENT OF LABOR	23400	.36
TOTAL	117000	1.80
PLANT MAINTENANCE		
LABOR	45900	.71
SUPERVISION, 25 PERCENT OF MAINTENANCE LABOR	11500	.18
MATERIALS	38200	.59
TOTAL	95600	1.48
PAYROLL OVERHEAD, 25 PERCENT OF ABOVE PAYROLL	43600	.67
OPERATING SUPPLIES, 20 PERCENT OF PLANT MAINTENANCE	19100	.29
TOTAL DIRECT COST	298700	4.60
INDIRECT COST, 20 PERCENT OF DIRECT LABOR AND MAINTENANCE	42500	.65
FIXED COST		
INSURANCE, 1.0 PERCENT OF TOTAL PLANT COST	23400	.36
DEPRECIATION, 20 YEAR LIFE	116900	1.80
TOTAL OPERATING COST	481500	7.41

APPENDIX B.--400-TON-PER-DAY INCINERATOR RESIDUE PLANT--8-HOUR DAY

TABLE B-1. - Raw material, utility, and labor requirements, 400-tpd incinerator residue plant--8-hour day

	Quantity per ton of dry incinerator residue
Flocculant.....pound..	0.02
Ferrosilicon.....do....	0.01
Flotation reagent.....do....	0.08
Electric power.....kilowatt-hours..	12.46
Process water.....thousand gallons..	0.07
Natural gas.....million Btu..	0.16
Direct operating labor.....man-hour..	0.18

TABLE B-2. - Major items of equipment, 400-tpd incinerator residue plant--8-hour day

Section and item	Quantity	Unit size
Primary separation and water recovery:		
Trommel.....	1	8 feet in diameter by 15 feet long.
Shredder.....	1	800 horsepower.
Thickener.....	1	54 feet in diameter.
Rotary vacuum filter.....	1	350 square feet.
Metal recovery:		
Permanent-magnet drum separator	1	30 inches in diameter by 24 inches wide.
Baler.....	1	100 horsepower.
Hammer mill.....	1	15 horsepower.
Electromagnet drum separator...	1	30 inches in diameter by 30 inches wide.
Glass recovery:		
Harz jig.....	6	24 by 36 inches, 4 compartments.
Roll crusher.....	1	30 horsepower.
Mineral jig.....	3	16 by 24 inches, duplex.
Roll crusher.....	1	15 horsepower.
Matrix-type, high-intensity magnetic separator.....	2	10 tons per hour.
Flotation unit.....	2	38 by 38 inches, 6 cells.
Dryer.....	1	6.25 feet in diameter by 52 feet long.
Nonferrous metals upgrading:		
Heavy-medium separator.....	1	1.5 feet in diameter by 4 feet long.
Permanent-magnet drum separator	1	30 inches in diameter by 12 inches wide.

TABLE B-3.-EQUIPMENT COST SUMMARY,
PRIMARY SEPARATION AND WATER RECOVERY SECTION
400 TPD INCINERATOR RESIDUE PLANT--8 HOUR DAY

ITEM	COST(1) EQUIPMENT	LABOR	TOTAL
HOPPER	$ 2500	$ 100	$ 2600
APRON FEEDER	5500	800	6300
BELT CONVEYOR	23300	4200	27500
TROMMEL	18000	2200	20200
BELT CONVEYOR	16000	2900	18900
BELT CONVEYOR	10000	1800	11800
PRIMARY SCREEN	3700	400	4100
BELT CONVEYOR	6900	1200	8100
BELT CONVEYOR	7500	1300	8800
PUMP	2000	100	2100
SURGE BIN	7900	400	8300
APRON FEEDER	5500	800	6300
SHREDDER	77600	10900	88500
SECONDARY SCREEN	2800	300	3100
BUCKET ELEVATOR	4200	600	4800
BELT CONVEYOR	5800	1000	6800
PUMP	1300	100	1400
SPIRAL CLASSIFIER	4500	400	4900
PUMP	1200	100	1300
BELT CONVEYOR	5200	900	6100
SURGE HOPPER	500	100	600
MIXING TANK	3000	300	3300
METERING PUMPS	1100	100	1200
SCALE	200	100	300
THICKENER	27000	2700	29700
PUMP	1900	100	2000
PUMPS	4600	100	4700
ROTARY VACUUM DRUM FILTER	35900	3600	39500
BELT CONVEYOR	2900	500	3400
STORAGE TANK	18800	1900	20700
PUMP	4000	200	4200
TOTAL	311300	40200	351500
FRONT END LOADER			8100
TOTAL EQUIPMENT COST X FACTOR INDICATED			
FOUNDATIONS, X .070			21800
BUILDINGS, X .250			77800
STRUCTURES, X .050			15600
INSTRUMENTATION, X .010			3100
ELECTRICAL, X .140			43600
PIPING, X .100			31100
PAINTING, X .010			3100
MISCELLANEOUS, X .100			31100
TOTAL			227200
TOTAL DIRECT COST			586800
FIELD INDIRECT, 10.0 PERCENT OF TOTAL DIRECT COST			53700
TOTAL CONSTRUCTION COST			645500
ENGINEERING, 5.0 PERCENT OF TOTAL CONSTRUCTION COST			32300
ADMINISTRATION AND OVERHEAD, 5.0 PERCENT OF TOTAL CONSTRUCTION COST			32300
SUBTOTAL			710100
CONTINGENCY, 10.0 PERCENT OF ABOVE SUBTOTAL			71000
SUBTOTAL			781100
CONTRACTOR'S FEE, 5.0 PERCENT OF ABOVE SUBTOTAL			39100
SECTION COST			820200

(1) EQUIPMENT COSTS ARE BASED ON THE M AND S INDEX OF 386.1.

TABLE B-4.-EQUIPMENT COST SUMMARY, METAL RECOVERY SECTION
400 TPD INCINERATOR RESIDUE PLANT--8 HOUR DAY

ITEM	COST(1) EQUIPMENT	LABOR	TOTAL
MAGNETIC SEPARATOR	$ 8200	$ 800	$ 9000
BELT CONVEYOR	9900	1800	11700
SURGE HOPPER	300	100	400
APRON FEEDER	3700	600	4300
BALER	79800	20000	99800
ROLLER CONVEYOR	2100	300	2400
CAR PULLER	2500	200	2700
HAMMERMILL	2800	400	3200
TERTIARY SCREEN	2200	300	2500
BELT CONVEYOR	5700	1000	6700
BELT CONVEYOR	7400	1300	8700
SURGE HOPPER	1300	100	1400
PUMP	1800	100	1900
MAGNETIC SEPARATOR	11500	1100	12600
BELT CONVEYOR	7500	1300	8800
SURGE HOPPER	400	100	500
SPIRAL CLASSIFIER	5800	600	6400
PUMP	900	100	1000
TOTAL	153800	30200	184000
CRANE			(2) 6600
TOTAL EQUIPMENT COST X FACTOR INDICATED			
FOUNDATIONS, X .070			10800
BUILDINGS, X .250			38500
STRUCTURES, X .100			15400
INSTRUMENTATION, X .010			1500
ELECTRICAL, X .140			21500
PIPING, X .100			15400
PAINTING, X .010			1500
MISCELLANEOUS, X .100			15400
TOTAL			120000
TOTAL DIRECT COST			310600
FIELD INDIRECT, 10.0 PERCENT OF TOTAL DIRECT COST			31100
TOTAL CONSTRUCTION COST			341700
ENGINEERING, 5.0 PERCENT OF TOTAL CONSTRUCTION COST			17100
ADMINISTRATION AND OVERHEAD, 5.0 PERCENT OF TOTAL CONSTRUCTION COST			17100
SUBTOTAL			375900
CONTINGENCY, 10.0 PERCENT OF ABOVE SUBTOTAL			37600
SUBTOTAL			413500
CONTRACTOR'S FEE, 5.0 PERCENT OF ABOVE SUBTOTAL			20700
SECTION COST			434200

(1) EQUIPMENT COSTS ARE BASED ON THE M AND S INDEX OF 386.1.
(2) INSTALLED COST.

TABLE B-5.-EQUIPMENT COST SUMMARY, GLASS RECOVERY SECTION
400 TPD INCINERATOR RESIDUE PLANT--8 HOUR DAY

ITEM	COST(1) EQUIPMENT	LABOR	TOTAL
HARZ JIG	$ 54700	$ 5500	$ 60200
PUMP	1900	100	2000
BELT CONVEYOR	6700	1200	7900
ROLL CRUSHER	10700	1100	11800
VIBRATING SCREEN	2600	300	2900
BELT CONVEYOR	7400	1300	8700
PUMP	3100	100	3200
SPIRAL CLASSIFIER	5800	600	6400
PUMP	3600	100	3700
MINERAL JIG	14700	1500	16200
PUMP	1500	100	1600
PUMP	2100	100	2200
VIBRATING SCREEN	3400	400	3800
PUMP	1900	100	2000
ROLL CRUSHER	8800	900	9700
VIBRATING SCREEN	4400	500	4900
PUMP	2500	100	2600
MATRIX SEPARATOR	112200	11200	123400
PUMP	1500	100	1600
PUMP	2600	100	2700
SPIRAL CLASSIFIER	5000	500	5500
PUMP	2900	100	3000
FLOTATION UNIT	22500	2200	24700
PUMP	1800	100	1900
VIBRATING SCREEN	2000	200	2200
PUMP	600	100	700
BELT CONVEYOR	7000	1300	8300
GLASS DRYER	82900	13300	96200
HOPPER	200	100	300
SCREW FEEDER	1100	200	1300
CYCLONE DUST COLLECTOR	5000	500	5500
BELT CONVEYOR	10500	1900	12400
STORAGE BIN	5000	200	5200
TOTAL	398600	46100	444700
TOTAL EQUIPMENT COST X FACTOR INDICATED			
FOUNDATIONS, X .070			27900
BUILDINGS, X .250			99700
STRUCTURES, X .100			39900
INSTRUMENTATION, X .010			4000
ELECTRICAL, X .140			55800
PIPING, X .100			39900
PAINTING, X .010			4000
MISCELLANEOUS, X .100			39900
TOTAL			311100
TOTAL DIRECT COST			755800
FIELD INDIRECT, 10.0 PERCENT OF TOTAL DIRECT COST			75600
TOTAL CONSTRUCTION COST			831400
ENGINEERING, 5.0 PERCENT OF TOTAL CONSTRUCTION COST			41600
ADMINISTRATION AND OVERHEAD, 5.0 PERCENT OF TOTAL CONSTRUCTION COST			41600
SUBTOTAL			914600
CONTINGENCY, 10.0 PERCENT OF ABOVE SUBTOTAL			91500
SUBTOTAL			1006100
CONTRACTOR'S FEE, 5.0 PERCENT OF ABOVE SUBTOTAL			50300
SECTION COST			1056400

(1) EQUIPMENT COSTS ARE BASED ON THE M AND S INDEX OF 386.1.

TABLE B-6.-EQUIPMENT COST SUMMARY,
NONFERROUS METALS UPGRADING SECTION
400 TPD INCINERATOR RESIDUE PLANT--8 HOUR DAY

ITEM	COST(1) EQUIPMENT	LABOR	TOTAL
HEAVY-MEDIUM SEPARATOR	$ 4400	$ 900	$ 5300
SINK DRAINAGE SCREEN	1400	200	1600
SINK WASHING SCREEN	1600	200	1800
FLOAT DRAINAGE SCREEN	1400	200	1600
FLOAT WASHING SCREEN	1600	200	1800
DILUTE MEDIUM SUMP	600	100	700
MAGNETIC FLOCCULATOR	200	100	300
MAGNETIC SEPARATOR	5400	500	5900
PUMP	500	100	600
DENSIFIER	3700	400	4100
STORAGE TANK	1000	100	1100
PUMP	500	100	600
DENSE MEDIUM SUMP	2700	100	2800
PUMP	1500	100	1600
BELT CONVEYOR	5100	900	6000
BELT CONVEYOR	5100	900	6000
DEMAGNETIZING COIL	200	100	300
TOTAL	36900	5200	42100
TOTAL EQUIPMENT COST X FACTOR INDICATED			
FOUNDATIONS, X .070			2600
BUILDINGS, X .250			9200
STRUCTURES, X .050			1800
INSTRUMENTATION, X .010			400
ELECTRICAL, X .140			5200
PIPING, X .100			3700
PAINTING, X .010			400
MISCELLANEOUS, X .100			3700
TOTAL			27000
TOTAL DIRECT COST			69100
FIELD INDIRECT, 10.0 PERCENT OF TOTAL DIRECT COST			6900
TOTAL CONSTRUCTION COST			76000
ENGINEERING, 5.0 PERCENT OF TOTAL CONSTRUCTION COST			3800
ADMINISTRATION AND OVERHEAD, 5.0 PERCENT OF TOTAL CONSTRUCTION COST			3800
SUBTOTAL			83600
CONTINGENCY, 10.0 PERCENT OF ABOVE SUBTOTAL			8400
SUBTOTAL			92000
CONTRACTOR'S FEE, 5.0 PERCENT OF ABOVE SUBTOTAL			4600
SECTION COST			96600

(1) EQUIPMENT COSTS ARE BASED ON THE M AND S INDEX OF 386.1.

TABLE B-7.-DIRECT LABOR REQUIREMENTS, 400 TPD INCINERATOR RESIDUE PLANT--8 HOUR DAY

SECTION AND ITEM	DIRECT LABOR ASSIGNMENT			
	NUMBER OF MEN	SHIFTS PER DAY	DAYS PER WEEK	TOTAL MEN REQUIRED
PRIMARY SEPARATION AND WATER RECOVERY SECTION				
FRONT END LOADER	1.0	1	5	1.0
TROMMEL	2.0	1	5	2.0
SHREDDER	1.0	1	5	1.0
SUBTOTAL				4.0
METAL RECOVERY SECTION				
BALER	1.0	1	5	1.0
CRANE	1.0	1	5	1.0
HAMMERMILL	1.0	1	5	1.0
SUBTOTAL				3.0
GLASS RECOVERY SECTION				
HARZ JIG	1.0	1	5	1.0
SUBTOTAL				1.0
NONFERROUS METALS UPGRADING SECTION				
HEAVY-MEDIUM SEPARATOR	1.0	1	5	1.0
SUBTOTAL				1.0
TOTAL				9.0

TABLE B-8.-ESTIMATED ANNUAL OPERATING COST, 400 TPD INCINERATOR RESIDUE PLANT--8 HOUR DAY

	ANNUAL COST	COST PER TON INCINERATOR RESIDUE
DIRECT COST		
RAW MATERIALS		
INCINERATOR RESIDUE AT $ .00 PER TON	$ 0	$ .00
FLOCCULANT AT $1.70 PER POUND	3300	.03
FLOTATION REAGENT AT $ .67 PER POUND	5900	.06
FERROSILICON AT $ .16 PER POUND	100	.01
TOTAL	9300	.10
UTILITIES		
ELECTRIC POWER AT 1 CENT PER KWHR	13000	.13
WATER, PROCESS AT 50 CENTS PER MGAL	3400	.03
NATURAL GAS AT 80 CENTS PER MMBTU	13100	.13
TOTAL	29500	.29
DIRECT LABOR		
LABOR AT $5.00 PER HOUR	93600	.90
SUPERVISION, 25 PERCENT OF LABOR	23400	.22
TOTAL	117000	1.12
PLANT MAINTENANCE		
LABOR	57000	.55
SUPERVISION, 25 PERCENT OF MAINTENANCE LABOR	14300	.14
MATERIALS	47500	.46
TOTAL	118800	1.15
PAYROLL OVERHEAD, 25 PERCENT OF ABOVE PAYROLL	47100	.45
OPERATING SUPPLIES, 20 PERCENT OF PLANT MAINTENANCE	23800	.23
TOTAL DIRECT COST	345500	3.34
INDIRECT COST, 20 PERCENT OF DIRECT LABOR AND MAINTENANCE	47200	.45
FIXED COST		
INSURANCE, 1.0 PERCENT OF TOTAL PLANT COST	27900	.27
DEPRECIATION, 20 YEAR LIFE	139600	1.34
TOTAL OPERATING COST	560200	5.40

APPENDIX C.--670-TON-PER-DAY INCINERATOR RESIDUE PLANT--24-HOUR DAY

TABLE C-1. - Raw material, utility, and labor requirements, 670-tpd incinerator residue plant--24-hour day

		Quantity per ton of dry incinerator residue
Flocculant	pound	0.02
Ferrosilicon	do	0.01
Flotation reagent	do	0.08
Electric power	kilowatt-hours	13.05
Process water	thousand gallons	0.07
Natural gas	million Btu	0.14
Direct operating labor	man-hour	0.30

TABLE C-2. - Major items of equipment, 670-tpd incinerator residue plant--24-hour day

Section and item	Quantity	Unit size
Primary separation and water recovery:		
Trommel	1	4 feet in diameter by 12 feet long.
Shredder	1	450 horsepower.
Thickener	1	40 feet in diameter.
Rotary vacuum filter	1	200 square feet.
Metal recovery:		
Permanent-magnet drum separator	1	30 inches in diameter by 12 inches wide.
Baler	1	100 horsepower.
Hammer mill	1	7.5 horsepower.
Electromagnet drum separator	1	30 inches in diameter by 18 inches wide.
Glass recovery:		
Harz jig	3	24 by 36 inches, 4 compartments.
Roll crusher	1	15 horsepower.
Mineral jig	2	16 by 24 inches, duplex.
Roll crusher	1	10 horsepower.
Matrix-type, high-intensity magnetic separator	1	10 tons per hour.
	1	5 tons per hour.
Flotation unit	1	38 by 38 inches, 6 cells.
Dryer	1	4.5 feet in diameter by 44 feet long.
Nonferrous metals upgrading:		
Heavy-medium separator	1	2 feet in diameter by 5 feet long.
Permanent-magnet drum separator	1	30 inches in diameter by 12 inches wide.

TABLE C-3.-EQUIPMENT COST SUMMARY,
PRIMARY SEPARATION AND WATER RECOVERY SECTION
670 TPD INCINERATOR RESIDUE PLANT--24 HOUR DAY

ITEM	COST(1) EQUIPMENT	LABOR	TOTAL
HOPPER	$ 1500	$ 100	$ 1600
APRON FEEDER	5500	800	6300
BELT CONVEYOR	23300	4200	27500
TROMMEL	9200	1100	10300
BELT CONVEYOR	16000	2900	18900
BELT CONVEYOR	10000	1800	11800
PRIMARY SCREEN	3500	400	3900
BELT CONVEYOR	6900	1200	8100
BELT CONVEYOR	7500	1300	8800
PUMP	1600	100	1700
SURGE BIN	4900	200	5100
APRON FEEDER	5500	800	6300
SHREDDER	51900	7300	59200
SECONDARY SCREEN	2300	300	2600
BUCKET ELEVATOR	4200	600	4800
BELT CONVEYOR	5800	1000	6800
PUMP	1100	100	1200
SPIRAL CLASSIFIER	4500	400	4900
PUMP	900	100	1000
BELT CONVEYOR	5200	900	6100
SURGE HOPPER	300	100	400
MIXING TANK	3000	300	3300
METERING PUMPS	900	100	1000
SCALE	200	100	300
THICKENER	17900	1800	19700
PUMP	1500	100	1600
PUMPS	3800	100	3900
ROTARY VACUUM DRUM FILTER	27700	2800	30500
BELT CONVEYOR	2900	500	3400
STORAGE TANK	10000	1000	11000
PUMP	2700	100	2800
TOTAL	242200	32600	274800
FRONT END LOADER			8100
TOTAL EQUIPMENT COST X FACTOR INDICATED			
FOUNDATIONS, X .070			17000
BUILDINGS, X .250			60600
STRUCTURES, X .050			12100
INSTRUMENTATION, X .010			2400
ELECTRICAL, X .140			33900
PIPING, X .100			24200
PAINTING, X .010			2400
MISCELLANEOUS, X .100			24200
TOTAL			176800
TOTAL DIRECT COST			459700
FIELD INDIRECT, 10.0 PERCENT OF TOTAL DIRECT COST			46000
TOTAL CONSTRUCTION COST			505700
ENGINEERING, 5.0 PERCENT OF TOTAL CONSTRUCTION COST			25300
ADMINISTRATION AND OVERHEAD, 5.0 PERCENT OF TOTAL CONSTRUCTION COST			25300
SUBTOTAL			556300
CONTINGENCY, 10.0 PERCENT OF ABOVE SUBTOTAL			55600
SUBTOTAL			611900
CONTRACTOR'S FEE, 5.0 PERCENT OF ABOVE SUBTOTAL			30600
SECTION COST			642500

(1) EQUIPMENT COSTS ARE BASED ON THE M AND S INDEX OF 386.1.

TABLE C-4.-EQUIPMENT COST SUMMARY, METAL RECOVERY SECTION
670 TPD INCINERATOR RESIDUE PLANT--24 HOUR DAY

ITEM	COST(1) EQUIPMENT	LABOR	TOTAL
MAGNETIC SEPARATOR	$ 5400	$ 500	$ 5900
BELT CONVEYOR	9900	1800	11700
SURGE HOPPER	200	100	300
APRON FEEDER	3700	600	4300
BALER	79800	20000	99800
ROLLER CONVEYOR	2100	300	2400
CAR PULLER	2500	200	2700
HAMMERMILL	2600	400	3000
TERTIARY SCREEN	2100	300	2400
BELT CONVEYOR	5700	1000	6700
BELT CONVEYOR	7400	1300	8700
SURGE HOPPER	1900	100	2000
PUMP	1500	100	1600
MAGNETIC SEPARATOR	8500	800	9300
BELT CONVEYOR	7400	1300	8700
SURGE HOPPER	200	100	300
SPIRAL CLASSIFIER	5000	500	5500
PUMP	700	100	800
TOTAL	146600	29500	176100
CRANE			(2) 6600
TOTAL EQUIPMENT COST X FACTOR INDICATED			
FOUNDATIONS, X .070			10300
BUILDINGS, X .250			36700
STRUCTURES, X .100			14700
INSTRUMENTATION, X .010			1500
ELECTRICAL, X .140			20500
PIPING, X .100			14700
PAINTING, X .010			1500
MISCELLANEOUS, X .100			14700
TOTAL			114600
TOTAL DIRECT COST			297300
FIELD INDIRECT, 10.0 PERCENT OF TOTAL DIRECT COST			29700
TOTAL CONSTRUCTION COST			327000
ENGINEERING, 5.0 PERCENT OF TOTAL CONSTRUCTION COST			16300
ADMINISTRATION AND OVERHEAD, 5.0 PERCENT OF TOTAL CONSTRUCTION COST			16300
SUBTOTAL			359600
CONTINGENCY, 10.0 PERCENT OF ABOVE SUBTOTAL			36000
SUBTOTAL			395600
CONTRACTOR'S FEE, 5.0 PERCENT OF ABOVE SUBTOTAL			19800
SECTION COST			415400

(1) EQUIPMENT COSTS ARE BASED ON THE M AND S INDEX OF 386.1.
(2) INSTALLED COST.

TABLE C-5.-EQUIPMENT COST SUMMARY, GLASS RECOVERY SECTION
670 TPD INCINERATOR RESIDUE PLANT--24 HOUR DAY

ITEM	COST(1) EQUIPMENT	LABOR	TOTAL
HARZ JIG	$ 27300	$ 2700	$ 30000
PUMP	1600	100	1700
BELT CONVEYOR	6700	1200	7900
ROLL CRUSHER	8800	900	9700
VIBRATING SCREEN	2100	300	2400
BELT CONVEYOR	7400	1300	8700
PUMP	2400	100	2500
SPIRAL CLASSIFIER	5000	500	5500
PUMP	2900	100	3000
MINERAL JIG	9800	1000	10800
PUMP	1500	100	1600
PUMP	1700	100	1800
VIBRATING SCREEN	2600	300	2900
PUMP	1600	100	1700
ROLL CRUSHER	8800	900	9700
VIBRATING SCREEN	3100	400	3500
PUMP	2100	100	2200
MATRIX SEPARATOR	56100	5600	61700
MATRIX SEPARATOR	37500	3700	41200
PUMP	1500	100	1600
PUMP	2100	100	2200
SPIRAL CLASSIFIER	5000	500	5500
PUMP	2400	100	2500
FLOTATION UNIT	11300	1100	12400
PUMP	1500	100	1600
VIBRATING SCREEN	1900	200	2100
PUMP	500	100	600
BELT CONVEYOR	7000	1300	8300
GLASS DRYER	58900	9400	68300
HOPPER	100	100	200
SCREW FEEDER	1100	200	1300
CYCLONE DUST COLLECTOR	3000	300	3300
BELT CONVEYOR	10400	1900	12300
STORAGE BIN	7700	400	8100
TOTAL	303400	35400	338800

TOTAL EQUIPMENT COST X FACTOR INDICATED	
FOUNDATIONS, X .070	21200
BUILDINGS, X .250	75900
STRUCTURES, X .100	30300
INSTRUMENTATION, X .010	3000
ELECTRICAL, X .140	42500
PIPING, X .100	30300
PAINTING, X .010	3000
MISCELLANEOUS, X .100	30300
TOTAL	236500
TOTAL DIRECT COST	575300
FIELD INDIRECT, 10.0 PERCENT OF TOTAL DIRECT COST	57500
TOTAL CONSTRUCTION COST	632800
ENGINEERING, 5.0 PERCENT OF TOTAL CONSTRUCTION COST	31600
ADMINISTRATION AND OVERHEAD, 5.0 PERCENT OF TOTAL CONSTRUCTION COST	31600
SUBTOTAL	696000
CONTINGENCY, 10.0 PERCENT OF ABOVE SUBTOTAL	69600
SUBTOTAL	765600
CONTRACTOR'S FEE, 5.0 PERCENT OF ABOVE SUBTOTAL	38300
SECTION COST	803900

(1) EQUIPMENT COSTS ARE BASED ON THE M AND S INDEX OF 386.1.

TABLE C-6.-EQUIPMENT COST SUMMARY,
NONFERROUS METALS UPGRADING SECTION
670 TPD INCINERATOR RESIDUE PLANT--24 HOUR DAY

ITEM	COST(1) EQUIPMENT	LABOR	TOTAL
HEAVY-MEDIUM SEPARATOR.....	$ 6000	$ 1200	$ 7200
SINK DRAINAGE SCREEN.....	1400	200	1600
SINK WASHING SCREEN.....	1600	200	1800
FLOAT DRAINAGE SCREEN.....	1400	200	1600
FLOAT WASHING SCREEN.....	1600	200	1800
DILUTE MEDIUM SUMP.....	800	100	900
MAGNETIC FLOCCULATOR.....	200	100	300
MAGNETIC SEPARATOR.....	5400	500	5900
PUMP.....	500	100	600
DENSIFIER.....	3700	400	4100
STORAGE TANK.....	1200	100	1300
PUMP.....	500	100	600
DENSE MEDIUM SUMP.....	3600	200	3800
PUMP.....	1500	100	1600
BELT CONVEYOR.....	5100	900	6000
BELT CONVEYOR.....	5100	900	6000
DEMAGNETIZING COIL.....	200	100	300
TOTAL.....	39800	5600	45400
TOTAL EQUIPMENT COST X FACTOR INDICATED			
FOUNDATIONS, X .070.....			2800
BUILDINGS, X .250.....			10000
STRUCTURES, X .050.....			2000
INSTRUMENTATION, X .010.....			400
ELECTRICAL, X .140.....			5600
PIPING, X .100.....			4000
PAINTING, X .010.....			400
MISCELLANEOUS, X .100.....			4000
TOTAL.....			29200
TOTAL DIRECT COST.....			74600
FIELD INDIRECT, 10.0 PERCENT OF TOTAL DIRECT COST.....			7500
TOTAL CONSTRUCTION COST.....			82100
ENGINEERING, 5.0 PERCENT OF TOTAL CONSTRUCTION COST...			4100
ADMINISTRATION AND OVERHEAD, 5.0 PERCENT OF TOTAL CONSTRUCTION COST.....			4100
SUBTOTAL.....			90300
CONTINGENCY, 10.0 PERCENT OF ABOVE SUBTOTAL.....			9000
SUBTOTAL.....			99300
CONTRACTOR'S FEE, 5.0 PERCENT OF ABOVE SUBTOTAL.....			5000
SECTION COST.....			104300

(1) EQUIPMENT COSTS ARE BASED ON THE M AND S INDEX OF 386.1.

TABLE C-7.-DIRECT LABOR REQUIREMENTS,
670 TPD INCINERATOR RESIDUE PLANT--24 HOUR DAY

SECTION AND ITEM	DIRECT LABOR ASSIGNMENT			
	NUMBER OF MEN	SHIFTS PER DAY	DAYS PER WEEK	TOTAL MEN REQUIRED
PRIMARY SEPARATION AND WATER RECOVERY SECTION				
FRONT END LOADER	1.0	3	5	3.0
TROMMEL	2.0	3	5	6.0
SHREDDER	1.0	3	5	3.0
SUBTOTAL				12.0
METAL RECOVERY SECTION				
BALER	1.0	3	5	3.0
CRANE	1.0	3	5	3.0
HAMMERMILL	1.0	3	5	3.0
SUBTOTAL				9.0
GLASS RECOVERY SECTION				
HARZ JIG	1.0	3	5	3.0
SUBTOTAL				3.0
NONFERROUS METALS UPGRADING SECTION				
HEAVY-MEDIUM SEPARATOR	1.0	1	5	1.0
SUBTOTAL				1.0
TOTAL				25.0

TABLE C-8.-ESTIMATED ANNUAL OPERATING COST, 670 TPD INCINERATOR RESIDUE PLANT--24 HOUR DAY

	ANNUAL COST	COST PER TON INCINERATOR RESIDUE
DIRECT COST		
RAW MATERIALS		
INCINERATOR RESIDUE AT $ .00 PER TON	$ 0	$ .00
FLOCCULANT AT $1.70 PER POUND	5400	.03
FLOTATION REAGENT AT $ .67 PER POUND	9800	.06
FERROSILICON AT $ .16 PER POUND	200	.01
TOTAL	15400	.10
UTILITIES		
ELECTRIC POWER AT 1 CENT PER KWHR	22700	.13
WATER, PROCESS AT 50 CENTS PER MGAL.	5700	.03
NATURAL GAS AT 80 CENTS PER MMBTU	20000	.11
TOTAL	48400	.27
DIRECT LABOR		
LABOR AT $5.00 PER HOUR	260000	1.49
SUPERVISION, 25 PERCENT OF LABOR	65000	.37
TOTAL	325000	1.86
PLANT MAINTENANCE		
LABOR	46200	.27
SUPERVISION, 25 PERCENT OF MAINTENANCE LABOR	11600	.07
MATERIALS	38600	.22
TOTAL	96400	.56
PAYROLL OVERHEAD, 25 PERCENT OF ABOVE PAYROLL	95700	.55
OPERATING SUPPLIES, 20 PERCENT OF PLANT MAINTENANCE	19300	.11
TOTAL DIRECT COST	600200	3.45
INDIRECT COST, 20 PERCENT OF DIRECT LABOR AND MAINTENANCE	84300	.48
FIXED COST		
INSURANCE, 1.0 PERCENT OF TOTAL PLANT COST	22800	.13
DEPRECIATION, 20 YEAR LIFE	114000	.65
TOTAL OPERATING COST	821300	4.71

APPENDIX D.--1,000-TON-PER-DAY INCINERATOR RESIDUE PLANT--24-HOUR DAY

TABLE D-1. - Raw material, utility, and labor requirements, 1,000-tpd incinerator residue plant--24-hour day

	Quantity per ton of dry incinerator residue
Flocculant.....pound..	0.02
Ferrosilicon.....do....	0.01
Flotation reagent.....do....	0.08
Electric power.....kilowatt-hours..	12.22
Process water.....thousand gallons..	0.07
Natural gas.....million Btu..	0.13
Direct operating labor.....man-hour..	0.20

TABLE D-2. - Major items of equipment, 1,000-tpd incinerator residue plant--24-hour day

Section and item	Quantity	Unit size
Primary separation and water recovery:		
Trommel.....	1	7 feet in diameter by 15 feet long.
Shredder.....	1	650 horsepower.
Thickener.....	1	50 feet in diameter.
Rotary vacuum filter.....	1	300 square feet.
Metal recovery:		
Permanent-magnet drum separator	1	30 inches in diameter by 18 inches wide.
Baler.....	1	100 horsepower.
Hammer mill.....	1	10 horsepower.
Electromagnet drum separator...	1	30 inches in diameter by 24 inches wide.
Glass recovery:		
Harz jig.....	5	24 by 36 inches, 4 compartments.
Roll crusher.....	1	25 horsepower.
Mineral jig.....	2	16 by 24 inches, duplex.
Roll crusher.....	1	15 horsepower.
Matrix-type, high-intensity magnetic separator.....	2	10 tons per hour.
Flotation unit.....	2	38 by 38 inches, 6 cells.
Dryer.....	1	5 feet in diameter by 49 feet long.
Nonferrous metals upgrading:		
Heavy-medium separator.....	1	2 feet in diameter by 5 feet long.
Permanent-magnet drum separator	1	30 inches in diameter by 12 inches wide.

TABLE D-3.-EQUIPMENT COST SUMMARY,
PRIMARY SEPARATION AND WATER RECOVERY SECTION
1000 TPD INCINERATOR RESIDUE PLANT--24 HOUR DAY

ITEM	COST(1) EQUIPMENT	LABOR	TOTAL
HOPPER	$ 2100	$ 100	$ 2200
APRON FEEDER	5500	800	6300
BELT CONVEYOR	23300	4200	27500
TROMMEL	13600	1600	15200
BELT CONVEYOR	16000	2900	18900
BELT CONVEYOR	10000	1800	11800
PRIMARY SCREEN	3400	400	3800
BELT CONVEYOR	6900	1200	8100
BELT CONVEYOR	7500	1300	8800
PUMP	1900	100	2000
SURGE BIN	6800	300	7100
APRON FEEDER	5500	800	6300
SHREDDER	67000	9400	76400
SECONDARY SCREEN	2600	300	2900
BUCKET ELEVATOR	4300	600	4900
BELT CONVEYOR	5800	1000	6800
PUMP	1200	100	1300
SPIRAL CLASSIFIER	4500	400	4900
PUMP	1100	100	1200
BELT CONVEYOR	5200	900	6100
SURGE HOPPER	500	100	600
MIXING TANK	3000	300	3300
METERING PUMPS	1100	100	1200
SCALE	200	100	300
THICKENER	24300	2400	26700
PUMP	1900	100	2000
PUMPS	4300	100	4400
ROTARY VACUUM DRUM FILTER	33400	3300	36700
BELT CONVEYOR	2900	500	3400
STORAGE TANK	17000	1700	18700
PUMP	4000	200	4200
TOTAL	286800	37200	324000
FRONT END LOADER			8100
TOTAL EQUIPMENT COST X FACTOR INDICATED			
FOUNDATIONS, X .070			20100
BUILDINGS, X .250			71700
STRUCTURES, X .050			14300
INSTRUMENTATION, X .010			2900
ELECTRICAL, X .140			40200
PIPING, X .100			28700
PAINTING, X .010			2900
MISCELLANEOUS, X .100			28700
TOTAL			209500
TOTAL DIRECT COST			541600
FIELD INDIRECT, 10.0 PERCENT OF TOTAL DIRECT COST			54200
TOTAL CONSTRUCTION COST			595800
ENGINEERING, 5.0 PERCENT OF TOTAL CONSTRUCTION COST			29800
ADMINISTRATION AND OVERHEAD, 5.0 PERCENT OF TOTAL CONSTRUCTION COST			29800
SUBTOTAL			655400
CONTINGENCY, 10.0 PERCENT OF ABOVE SUBTOTAL			65500
SUBTOTAL			720900
CONTRACTOR'S FEE, 5.0 PERCENT OF ABOVE SUBTOTAL			36000
SECTION COST			756900

(1) EQUIPMENT COSTS ARE BASED ON THE M AND S INDEX OF 386.1.

TABLE D-4.-EQUIPMENT COST SUMMARY, METAL RECOVERY SECTION
1000 TPD INCINERATOR RESIDUE PLANT--24 HOUR DAY

ITEM	COST(1) EQUIPMENT	LABOR	TOTAL
MAGNETIC SEPARATOR	$ 6900	$ 700	$ 7600
BELT CONVEYOR	9900	1800	11700
SURGE HOPPER	300	100	400
APRON FEEDER	3700	600	4300
BALER	79800	20000	99800
ROLLER CONVEYOR	2100	300	2400
CAR PULLER	2500	200	2700
HAMMERMILL	2700	400	3100
TERTIARY SCREEN	2100	300	2400
BELT CONVEYOR	5700	1000	6700
BELT CONVEYOR	7400	1300	8700
SURGE HOPPER	2600	100	2700
PUMP	1700	100	1800
MAGNETIC SEPARATOR	10100	1000	11100
BELT CONVEYOR	7400	1300	8700
SURGE HOPPER	300	100	400
SPIRAL CLASSIFIER	5800	600	6400
PUMP	900	100	1000
TOTAL	151900	30000	181900
CRANE			(2) 6600
TOTAL EQUIPMENT COST X FACTOR INDICATED			
FOUNDATIONS, X .070			10600
BUILDINGS, X .250			38000
STRUCTURES, X .100			15200
INSTRUMENTATION, X .010			1500
ELECTRICAL, X .140			21300
PIPING, X .100			15200
PAINTING, X .010			1500
MISCELLANEOUS, X .100			15200
TOTAL			118500
TOTAL DIRECT COST			307000
FIELD INDIRECT, 10.0 PERCENT OF TOTAL DIRECT COST			30700
TOTAL CONSTRUCTION COST			337700
ENGINEERING, 5.0 PERCENT OF TOTAL CONSTRUCTION COST			16900
ADMINISTRATION AND OVERHEAD, 5.0 PERCENT OF TOTAL CONSTRUCTION COST			16900
SUBTOTAL			371500
CONTINGENCY, 10.0 PERCENT OF ABOVE SUBTOTAL			37100
SUBTOTAL			408600
CONTRACTOR'S FEE, 5.0 PERCENT OF ABOVE SUBTOTAL			20400
SECTION COST			429000

(1) EQUIPMENT COSTS ARE BASED ON THE M AND S INDEX OF 386.1.
(2) INSTALLED COST.

TABLE D-5.-EQUIPMENT COST SUMMARY, GLASS RECOVERY SECTION
1000 TPD INCINERATOR RESIDUE PLANT--24 HOUR DAY

ITEM	COST(1) EQUIPMENT	LABOR	TOTAL
HARZ JIG	$ 45600	$ 4600	$ 50200
PUMP	1800	100	1900
BELT CONVEYOR	6700	1200	7900
ROLL CRUSHER	9800	1000	10800
VIBRATING SCREEN	2400	300	2700
BELT CONVEYOR	7400	1300	8700
PUMP	2800	100	2900
SPIRAL CLASSIFIER	5800	600	6400
PUMP	3400	100	3500
MINERAL JIG	9800	1000	10800
PUMP	1500	100	1600
PUMP	1900	100	2000
VIBRATING SCREEN	3000	400	3400
PUMP	1800	100	1900
ROLL CRUSHER	8800	900	9700
VIBRATING SCREEN	3900	500	4400
PUMP	2400	100	2500
MATRIX SEPARATOR	112200	11200	123400
PUMP	1500	100	1600
PUMP	2400	100	2500
SPIRAL CLASSIFIER	5000	500	5500
PUMP	2700	100	2800
FLOTATION UNIT	22500	2200	24700
PUMP	1700	100	1800
VIBRATING SCREEN	2000	200	2200
PUMP	500	100	600
BELT CONVEYOR	7000	1300	8300
GLASS DRYER	66200	10600	76800
HOPPER	200	100	300
SCREW FEEDER	1100	200	1300
CYCLONE DUST COLLECTOR	3700	400	4100
BELT CONVEYOR	10400	1900	12300
STORAGE BIN	10600	500	11100
TOTAL	368500	42100	410600
TOTAL EQUIPMENT COST X FACTOR INDICATED			
FOUNDATIONS, X .070			25800
BUILDINGS, X .250			92100
STRUCTURES, X .100			36800
INSTRUMENTATION, X .010			3700
ELECTRICAL, X .140			51600
PIPING, X .100			36800
PAINTING, X .010			3700
MISCELLANEOUS, X .100			36800
TOTAL			287300
TOTAL DIRECT COST			697900
FIELD INDIRECT, 10.0 PERCENT OF TOTAL DIRECT COST			69800
TOTAL CONSTRUCTION COST			767700
ENGINEERING, 5.0 PERCENT OF TOTAL CONSTRUCTION COST			38400
ADMINISTRATION AND OVERHEAD, 5.0 PERCENT OF TOTAL CONSTRUCTION COST			38400
SUBTOTAL			844500
CONTINGENCY, 10.0 PERCENT OF ABOVE SUBTOTAL			84400
SUBTOTAL			928900
CONTRACTOR'S FEE, 5.0 PERCENT OF ABOVE SUBTOTAL			46400
SECTION COST			975300

(1) EQUIPMENT COSTS ARE BASED ON THE M AND S INDEX OF 386.1.

TABLE D-6.-EQUIPMENT COST SUMMARY,
NONFERROUS METALS UPGRADING SECTION
1000 TPD INCINERATOR RESIDUE PLANT--24 HOUR DAY

ITEM	COST(1) EQUIPMENT	LABOR	TOTAL
HEAVY-MEDIUM SEPARATOR.....	$ 6000	$ 1200	$ 7200
SINK DRAINAGE SCREEN.....	1400	200	1600
SINK WASHING SCREEN.....	1600	200	1800
FLOAT DRAINAGE SCREEN.....	1400	200	1600
FLOAT WASHING SCREEN.....	1600	200	1800
DILUTE MEDIUM SUMP.....	900	100	1000
MAGNETIC FLOCCULATOR.....	200	100	300
MAGNETIC SEPARATOR.....	5400	500	5900
PUMP.....	500	100	600
DENSIFIER.....	3700	400	4100
STORAGE TANK.....	1400	100	1500
PUMP.....	500	100	600
DENSE MEDIUM SUMP.....	4500	200	4700
PUMP.....	1500	100	1600
BELT CONVEYOR.....	5100	900	6000
BELT CONVEYOR.....	5100	900	6000
DEMAGNETIZING COIL.....	200	100	300
TOTAL.....	41000	5600	46600
TOTAL EQUIPMENT COST X FACTOR INDICATED			
FOUNDATIONS, X .070.....			2900
BUILDINGS, X .250.....			10300
STRUCTURES, X .050.....			2000
INSTRUMENTATION, X .010.....			400
ELECTRICAL, X .140.....			5700
PIPING, X .100.....			4100
PAINTING, X .010.....			400
MISCELLANEOUS, X .100.....			4100
TOTAL.....			29900
TOTAL DIRECT COST.....			76500
FIELD INDIRECT, 10.0 PERCENT OF TOTAL DIRECT COST.....			7600
TOTAL CONSTRUCTION COST.....			84100
ENGINEERING, 5.0 PERCENT OF TOTAL CONSTRUCTION COST...			4200
ADMINISTRATION AND OVERHEAD, 5.0 PERCENT OF TOTAL CONSTRUCTION COST.....			4200
SUBTOTAL.....			92500
CONTINGENCY, 10.0 PERCENT OF ABOVE SUBTOTAL.....			9200
SUBTOTAL.....			101700
CONTRACTOR'S FEE, 5.0 PERCENT OF ABOVE SUBTOTAL.....			5100
SECTION COST.....			106800

(1) EQUIPMENT COSTS ARE BASED ON THE M AND S INDEX OF 386.1.

TABLE D-7.-DIRECT LABOR REQUIREMENTS,
1000 TPD INCINERATOR RESIDUE PLANT--24 HOUR DAY

SECTION AND ITEM	DIRECT LABOR ASSIGNMENT			
	NUMBER OF MEN	SHIFTS PER DAY	DAYS PER WEEK	TOTAL MEN REQUIRED
PRIMARY SEPARATION AND WATER RECOVERY SECTION				
FRONT END LOADER	1.0	3	5	3.0
TROMMEL	2.0	3	5	6.0
SHREDDER	1.0	3	5	3.0
SUBTOTAL				12.0
METAL RECOVERY SECTION				
BALER	1.0	3	5	3.0
CRANE	1.0	3	5	3.0
HAMMERMILL	1.0	3	5	3.0
SUBTOTAL				9.0
GLASS RECOVERY SECTION				
HARZ JIG	1.0	3	5	3.0
SUBTOTAL				3.0
NONFERROUS METALS UPGRADING SECTION				
HEAVY-MEDIUM SEPARATOR	1.0	1	5	1.0
SUBTOTAL				1.0
TOTAL				25.0

TABLE D-8.-ESTIMATED ANNUAL OPERATING COST, 1000 TPD INCINERATOR RESIDUE PLANT--24 HOUR DAY

	ANNUAL COST	COST PER TON INCINERATOR RESIDUE
DIRECT COST		
RAW MATERIALS		
INCINERATOR RESIDUE AT $ .00 PER TON	$ 0	$ .00
FLOCCULANT AT $1.70 PER POUND	8100	.03
FLOTATION REAGENT AT $ .67 PER POUND	14600	.06
FERROSILICON AT $ .16 PER POUND	400	.01
TOTAL	23100	.10
UTILITIES		
ELECTRIC POWER AT 1 CENT PER KWHR	31800	.12
WATER, PROCESS AT 50 CENTS PER MGAL	8500	.03
NATURAL GAS AT 80 CENTS PER MMBTU	26600	.10
TOTAL	66900	.25
DIRECT LABOR		
LABOR AT $5.00 PER HOUR	260000	1.00
SUPERVISION, 25 PERCENT OF LABOR	65000	.25
TOTAL	325000	1.25
PLANT MAINTENANCE		
LABOR	55000	.21
SUPERVISION, 25 PERCENT OF MAINTENANCE LABOR	13800	.05
MATERIALS	45800	.18
TOTAL	114600	.44
PAYROLL OVERHEAD, 25 PERCENT OF ABOVE PAYROLL	98500	.38
OPERATING SUPPLIES, 20 PERCENT OF PLANT MAINTENANCE	22900	.09
TOTAL DIRECT COST	651000	2.51
INDIRECT COST, 20 PERCENT OF DIRECT LABOR AND MAINTENANCE	87900	.34
FIXED COST		
INSURANCE, 1.0 PERCENT OF TOTAL PLANT COST	26300	.10
DEPRECIATION, 20 YEAR LIFE	131500	.51
TOTAL OPERATING COST	896700	3.46

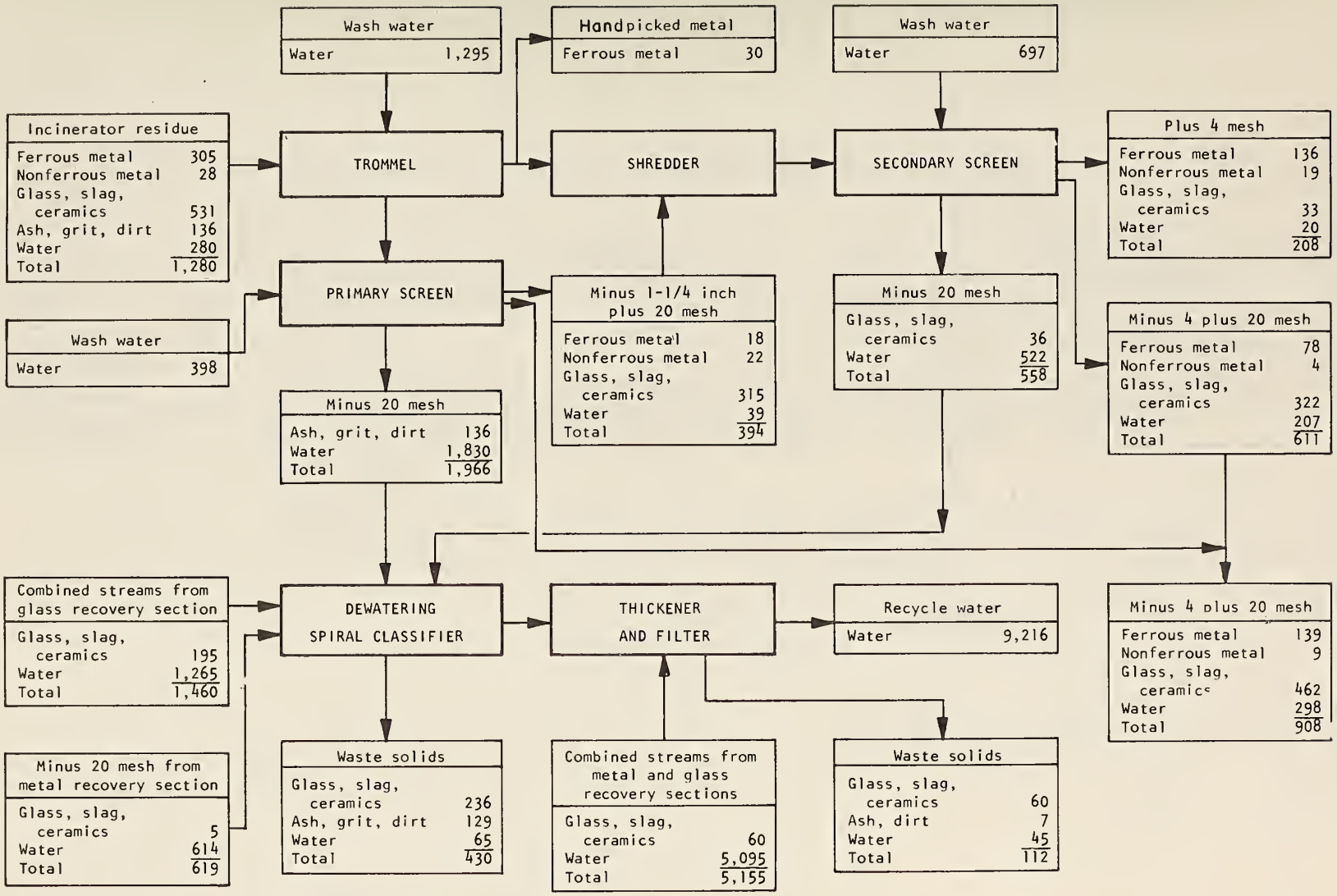

FIGURE D-1. - Material balance, primary separation and water recovery section, tons per day.

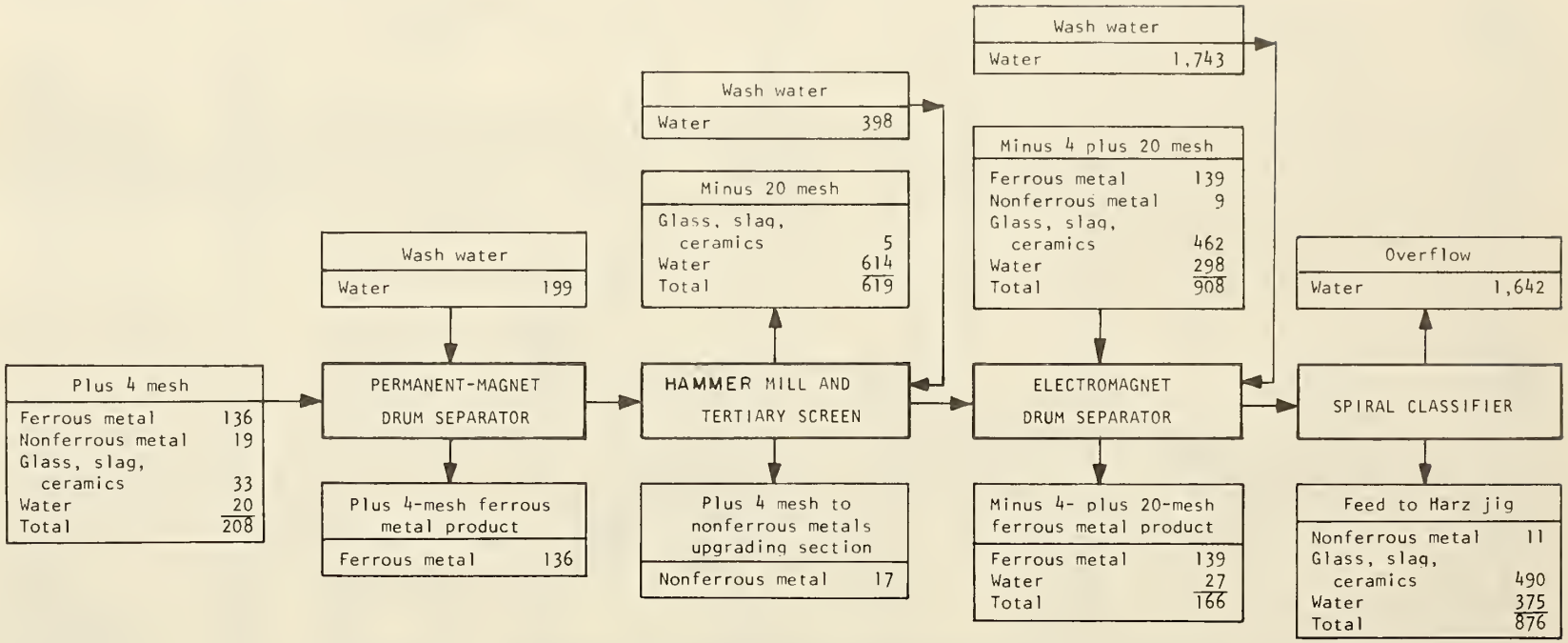

FIGURE D-2. - Material balance, metal recovery section, tons per day.

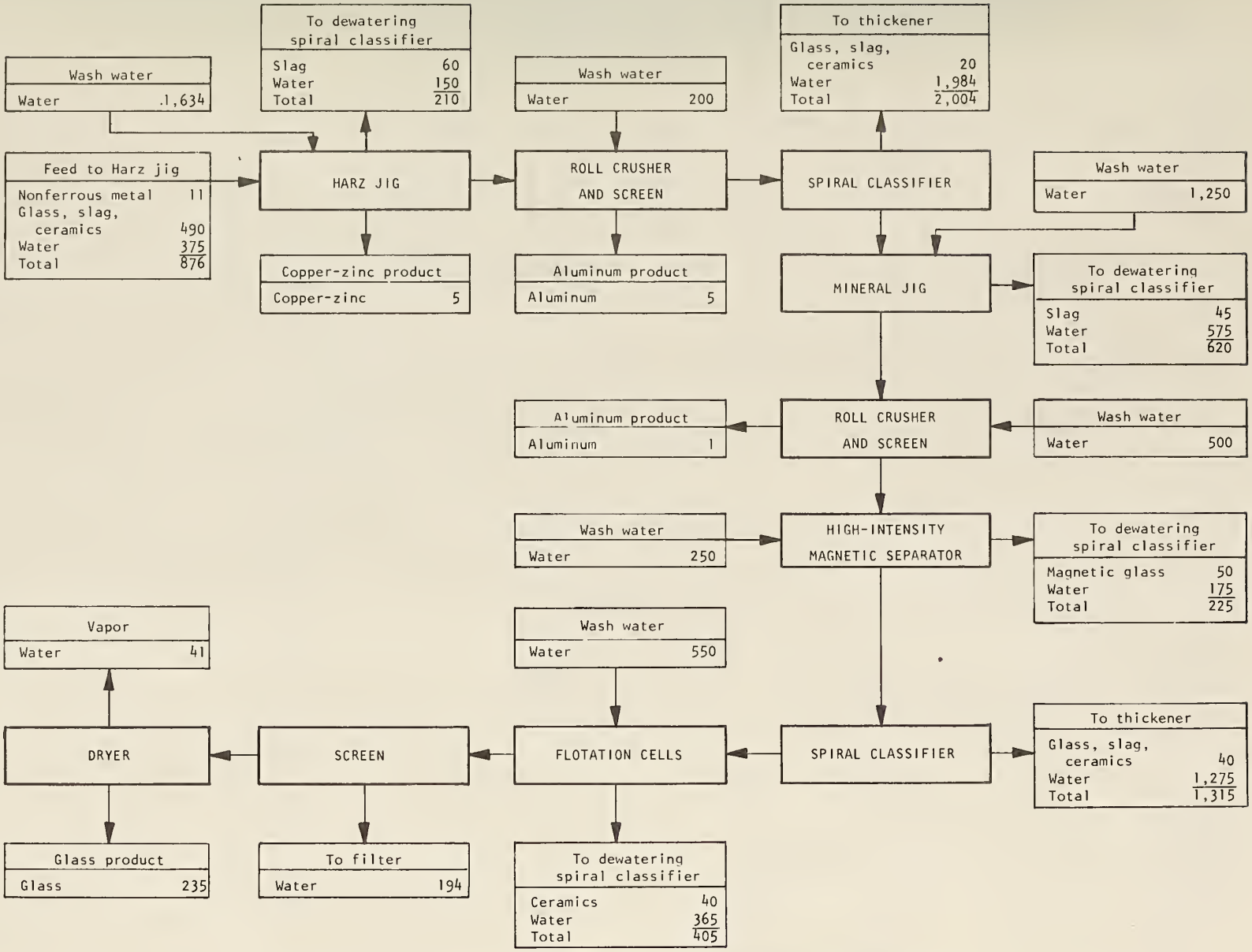

FIGURE D-3. - Material balance, glass recovery section, tons per day.

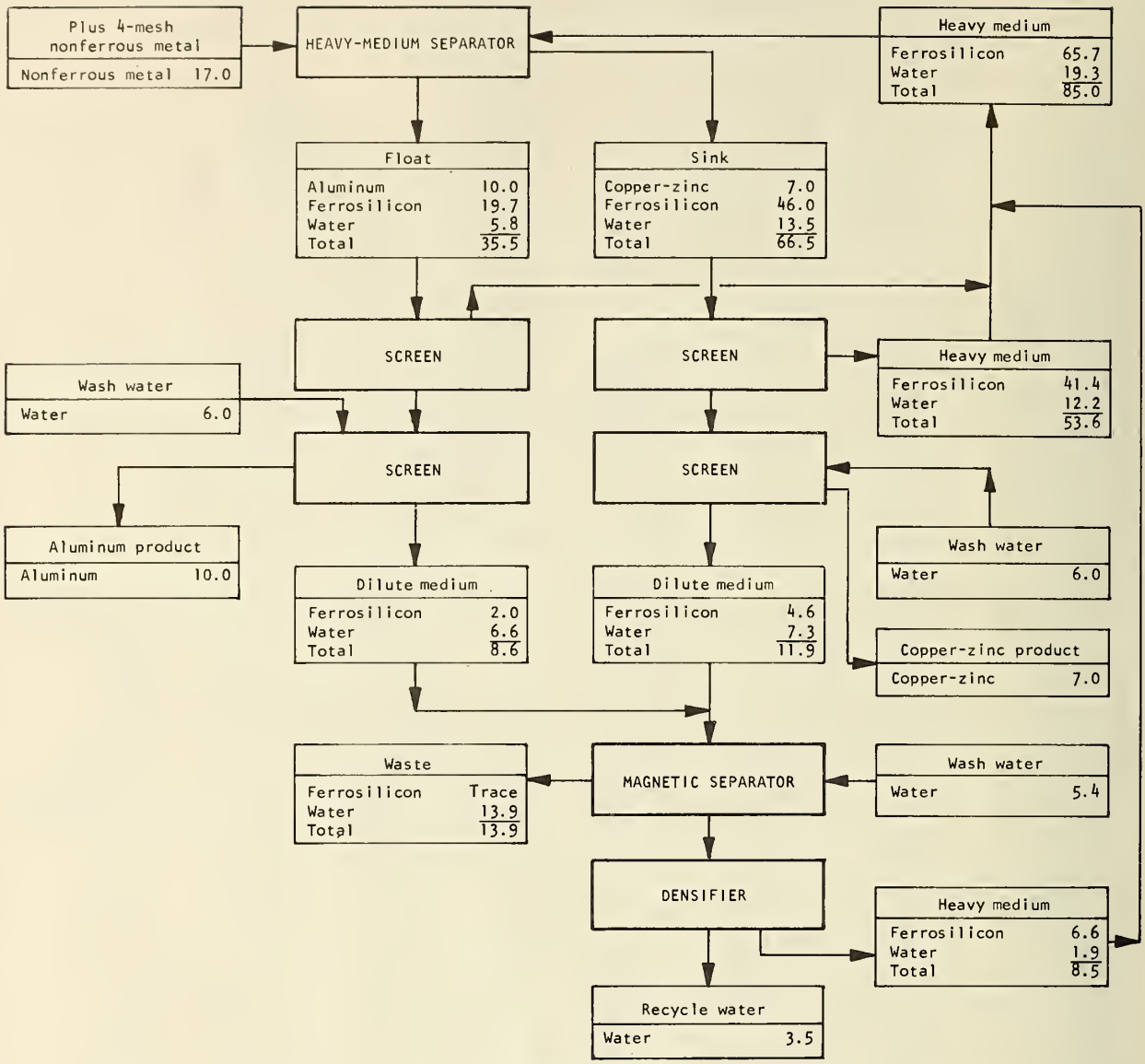

FIGURE D-4. - Material balance, nonferrous metals upgrading section, tons per day.

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